

The science of language and the language of science

Language, that most fundamental of human facilities is under the microscope again. A recent publication in the journal *Nature* describes magnetic resonance imaging (MRI) studies which cast doubt on the long-held belief that human languages share universal features that are dictated by human brain structure, that certain centres of our brains are the sole driver of language. Methods derived from evolutionary biology are now being used to trace the development of grammar in several language families. According to BBC news "The results suggest that features shared across language families evolved independently in each lineage. The authors say cultural evolution, not the brain, drives language development. At the heart of both studies is a method based on what are known as phylogenetic studies. Lead author Michael Dunn, an evolutionary linguist at the Max Planck Institute for Psycholinguistics in the Netherlands, said the approach is akin to the study of pea plants by Gregor Mendel, which ultimately led to the idea of heritability of traits."

It is quite understandable that 'inherent language' should have been adopted as a theory. Almost from the moment that we started to think in terms of computers it was natural to conceive of a new-born baby's brain as an 'uncommitted logic array' with some ROM to represent those components of behaviour which we might call instinctive. How else can a baby learn language so fast? But, does a baby learn fast? There is the story told of the four-year old at the bottom of a large family who, up to the time of the story had never spoken. One day, while sitting at the table he said reproachfully to his mother "you forgot the sugar". The mother, completely taken aback by his first utterance asked "why have you never spoken before?" to which he answered "well, you never forgot the sugar before".

I think that there are some blurred distinctions which should be highlighted here. There is a massive difference between being able to comprehend language and being able to communicate it. When I look back at my early attempt to play the trumpet I feel sorry for my family and for my neighbours. One has to blow and to spit the tongue through the front teeth while making raspberry noises with the lips. Once the noise starts the entire process has got to be controlled in terms of pitch and amplitude. Now, all of that takes time and once learnt, is not forgotten, even if the lip may be well out of practice. Compared with acoustic communication this is nothing. Having been peripherally involved with the computer simulation of the vocal tract I am aware of the complex nature of the co-ordination that is required to form and deliver even a simple word. I am convinced that babies can comprehend language long before they can speak and one can frequently witness their frustration when they are not able to get their message across. A proof of this is the ability of babies to hand signal desires and emotions. It may be a reduced language set, but it is extraordinary to see it in action.

So, language is a convenience to convey ideas. With only one language we must communicate desires, concepts and emotions within the constraints that that language imposes. How often does one have to address a group of people and yet UK English does not possess a second person plural? French have 'vous', German has 'Sie', Dutch has 'jullie' and Mandarin has 'nimen'. English is straining for such a word. American English has adopted 'you guys' irrespective of gender. A Dubliner might be heard saying "yiz are a bunch of fewels (fools)". Many in Britain are appalled by the ingress of 'youse' into the language, failing to realise that it is trespassing because ordinary people need it as part of the arsenal of communications tools.

There are words which convey a meaning in one language that cannot be conveyed in another. For example 'gemütlich' in German conveys a sense that is warm and congenial, pleasant and friendly. Because such a word is missing in English a speaker might use the German word to convey the idea if they feel confident that their audience will understand. Having facility in more than one language opens up new horizons. A sentence such as "I went of my house and there was my car, the one that I had bought only two weeks ago, gone" is a direct translation from how the sense of the event might be communicated in the Irish language. The speaker first paints the picture of the presence of the car before indicating its non-presence.

The report from *Nature* talks about the methods that will be used to determine the genetic tree of languages, but I thought that all of that had been done before. Was there not that professor of biology from Birmingham university - Lancelot Hogben, who wrote "Mathematics for the Million"? Did he not also wrote a wonderful book called "The Mother Tongue" which addressed so much of this?

It is said that language can reside in different parts of the brain and as evidence we have cases of people who have previously been fluent in both Chinese and Japanese, having facility in only one after suffering a stroke. I decided to apply this in a practical way. I grew up vocalising what I was reading, which of course slows down the process. This carried over into my self-tuition of the trumpet. When reading a score my mind went something like "That is a D (low), therefore use fingers 1 and 3." Even when I had to transpose for trumpet in C for certain orchestral music the process was "Okay so that is an E, so read up one note which makes it an F, but of course we add two sharps which means that that is F#, therefore press down second valve." With this handicap I could never play a piano and I am still agog at how an organist can read three staves at speed. Anyway, when my son started to learn the violin I decided to keep him company and learnt the 'cello from scratch. Having no prior experience of the bass clef I decided to bypass vocalisation and interpret the note on the score only as a position under the hand. It worked extremely well, but then I went to teach in China for a year and could not bring my instrument with me. On my return I found that I had completely forgotten everything and would have to start again, something that I am still putting off.

While I was in China I took classes in Mandarin where I also leant to read and write Chinese characters. In many ways the language is simple. Okay, so you have to get accustomed to the tones and you will get them wrong, sometimes will get them embarrassingly wrong. It is almost like a subset of other languages. Verbs have no tense. The speaker must indicate the time in the future when an action will take place or simply add 'le' to indicate that an action is past. There is no comparative in the sense of big, bigger, biggest. 'Zui da' means the 'most big', but for bigger of two you have to say 'A compared with B is big'. Most interesting of all, something that I have already incorporated into my English usage is the posing of a question by means of a verb and its negation. 'Shi bu shi' literally translates 'be not be', meaning- are you? So, when Hamlet says "To be or not to be" for the Chinese that is definitely a question.

It is now four years since I was last in China but I keep up my reading and writing. In order to read a simple text one needs at least 5000 characters. Children starting school probably have 1000 and from then on 70% of primary education is concerned with learning HanZi, as it is called. Do they remember them if they don't use them? I have probably encountered 2000 characters but at any time I forget 1500 of them. The major problem is that it is not always the

same 1500. Remembering my bad experiences with the 'cello keeps me at my studies, waiting for the day when I won't forget.

This brings me to the language of science which supposedly is mathematics. Before I retired I was set to teach remedial mathematics to first year students. Some might view this with disdain, but for me it was a challenge. "I am no good at mathematics" was the universal whinge. "It is not that you are no good at mathematics" I would respond "it is just that you have had dreadful teachers". "So, what" I would ask them "is mathematics?" Getting no answer, I would proceed to the story about the dictionary of Inuit having fifteen words to describe the quality of snow and yet only one word to describe the quality of vegetation. My argument being that if you live in Northern Canada then it is critical that you should be able to communicate to others the precise type of snow that they might encounter. Now snow might be alien to people of many countries, but growing up in Ireland and later working in the UK midlands it was that soft stuff that fell from the sky and turned to slush which ruined your shoes. Later when I lived for a time in the mountains to the east of Manchester I learnt otherwise. Snow might fall as beautiful crystals at -17°C. The blocked roads could be quickly cleared, but if there was a wind that night then it would be blown from the fields and block roads again. Commentators on the internet reckon that the story about the Inuit dictionary is apocryphal and this set me to find if English had different words for types of snow and I was pleasantly surprised with the following distinct cold weather terms: graupel, crystal, blizzard, flurries, granular, crystalline, fluffy, powder, white-out (very scary), snow-slab, snow-pack, blown-snow, hoar-frost, ice-storm, black-ice.

None of this will get away from the impact that my argument had. Many of the supposed 'bad at mathematics' students already had French or Spanish and understanding that mathematics was merely a language they could immediately see that it must have a vocabulary, a grammar and syntax. Some subsequently became very good at the subject.

Taking this point, an expression such as $\nabla \bar{A} \times \bar{B}$ has very precise meaning which will be immediately understood by a broad spectrum of scientists. However even in mathematics there is what I would call a serious misuse of English. Quantum theory means something to me, but I get knotted up in string theory. Pure mathematics uses the words 'tower', 'fields' and 'chains' to denote certain entities. People who are involved with probabilistic differential equations will talk about martingales. For me that will always be an arrangement for preventing a horse from keeping its head too high. Specialist language intended to exclude others or for an inclusive group is not new. The telegraphers at either end of the early trans-oceanic telegraph cables had to develop a condensed language which we now call telegraphese and outside work they used it amongst their families. Right up until the time he died my late father-in-law (fourth generation of a cable family) would always write to my wife in telegraphese.

So, as mathematicians try to confound us with their use of language, might it not be an interesting exercise to apply phylogenetic methods to the language of science?

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